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IN THE UNITED STATES PATENTS AND TRADEMARK OFFICE

Applicant : Ryoichi Okuyama et al.  
Title : HYDROGEN GENERATING METHOD AND HYDROGEN  
GENERATING SYSTEM BASED ON THE METHOD  
Serial No. : 10/584,267  
Filed : June 23, 2006  
Group Art Unit : 1731  
Examiner : Noah S. Weise

Mail Stop: Appeal Brief - Patents  
Commissioner for Patents  
P.O. Box 1450, Alexandria, VA 22313-1450

October 24, 2011

REPLY BRIEF

Sir:

A reply brief is filed herewith in response to the Examiner's answer to the appeal brief filed on May 31, 2011.

On pages 4-5 of the Examiner's answer regarding claims 13 and 14, it is stated that Cropley et al. (US 6,811,905) teaches that there is a means for collecting (discharging) methanol, water, and carbon dioxide. This means is located at the anode (fuel electrode) side of the fuel cell and thus *would* be capable of collecting hydrogen if it was generated on this electrode. Applicants disagree with this.

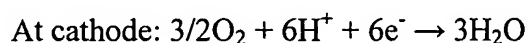
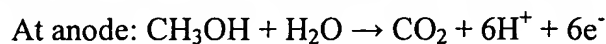
First of all, it was not known that hydrogen is generated at the fuel electrode side at the time the present invention was made. Second, the Examiner's argument is completely based on his assumption (no supporting evidence was provided). Therefore, Appellants submit that there is no way to argue, discuss, or rebut such assumption with the given fact that it was not known

that hydrogen is generated at the fuel electrode side at the time the present invention was made. The anticipation rejection over Cropley et al. is not tenable.

On pages 5-6 of the Examiner's answer regarding claims 58-66 and 68-76, it is stated that the claims do not further limit claims 13 and 14 and so they are anticipated by Cropley et al. Appellants submit that claims 58-66 and 68-76 define the conditions that hydrogen is generated and depend from claims 13 and 14, which are believed to be not anticipated or obvious over Cropley et al. Dependent claims 58-66 and 68-76 should be allowable over Cropley et al.

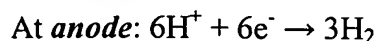
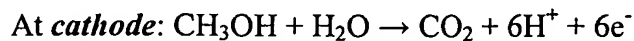
On page 7 of the Examiner's answer regarding claims 67 and 77, Appellants submit the following.

A methanol fuel cell of Cropley et al. generates electricity by producing the following reactions as shown in Fig. 1, and is used as a fuel cell (DMFC),



Also, as shown in Fig. 1, H does not become H<sub>2</sub> gas. H is involved in the above-mentioned reactions by moving through a partition membrane as H<sup>+</sup>. In the case of considering the usage as the fuel cell (DMFC), if H<sup>+</sup> becomes H<sub>2</sub> gas, it follows that the above-mentioned reactions would not take place. Accordingly, it may be said that it is based on the assumption that the reaction of producing H<sub>2</sub> gas wherein H<sup>+</sup> is consumed, would not take place.

On the other hand, the present invention generates electricity due to the below-mentioned reactions, and at the same time, generates hydrogen so as to be "a hydrogen generating system." In claim 13, the oxygen supply is reduced so that the voltage between the fuel electrode and the oxidizing electrode is adjusted to 200-600 mV. However, in the present invention, it was found that the following reactions which completely differ from the above-mentioned reactions take place, and that hydrogen is generated at anode so as to be "a hydrogen generating system."



Therefore, in claim 13, it is important to provide "means for collecting hydrogen-containing gas" for anode (fuel electrode) in order to provide "a hydrogen generating system."

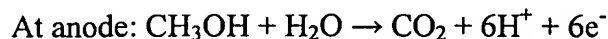
The point of the invention of claim 13 is that hydrogen can be generated at anode. Since Cropley et al. do not disclose that *hydrogen* is generated at anode, "collecting hydrogen" cannot

be made. Also, in Cropley et al., due to the above-mentioned reactions, CO<sub>2</sub> (carbon dioxide) is generated at anode, and CH<sub>3</sub>OH (methanol) and H<sub>2</sub>O (water) which are raw materials, remain, so that in order to discard or circulate them, “a means for collecting methanol, water, carbon dioxide” is provided. However, it is irrational to say that since methanol, water, and carbon dioxide can be collected, hydrogen can be collected even though Cropley et al. do not disclose that hydrogen is generated at anode.

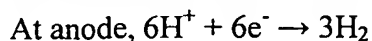
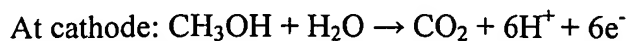
Also, it can be said that “a means for collecting” differs if materials to be collected differ, so that even if hydrogen is generated in Cropley et al., which it is not, there is a significant difference between that “methanol, water, and carbon dioxide” which are unreacted reactants or wastes are collected in order to be used as the DMFC, and that “hydrogen” which is a product is collected in order to be used as “a hydrogen generating system.” Therefore, it cannot be said that “a means for collecting” of claim 13 and Cropley et al. are “a functionally equivalent means.”

The same arguments can be applied to claim 14.

Although Cropley et al. discloses that H<sub>2</sub> gas is generated at cathode (see column 15, lines 24-35), according to the description, H<sub>2</sub> gas is generated in the above-mentioned formulas instead of generating H<sub>2</sub>O (water) by supplying e<sup>-</sup> (applying an electric current) from outside without supplying oxygen to cathode, so that reaction formulas will be as follows.



In contrast, in claim 14, e<sup>-</sup> is supplied from outside, and due to the above-mentioned reactions, H<sub>2</sub> is generated at cathode (oxidizing electrode), and at the same time, by adjusting the voltage between the fuel electrode and the oxidizing electrode to 300-1000 mV, due to the following reactions, H<sub>2</sub> is generated at anode (fuel electrode) without any relation to e<sup>-</sup> supplied from outside.



Therefore, in order to be used as “a hydrogen generating system,” providing the “means for collecting hydrogen-containing gas” for anode (fuel electrode), is important as in the present invention of claim 13.

Also, the effect of the present invention of claim 14 is specifically described in column [0226] of the specification of the present application such that

“Relation of the rate of hydrogen evolution with the current density applied in the test is shown in Fig. 43. It was found that the efficiency of hydrogen evolution (efficiency of hydrogen evolution relative to electric energy supplied) becomes equal to or more than 100% (100% efficiency of hydrogen evolution is represented by the dashed line in Fig. 43) in certain areas when the current density is kept not more than 40 mA/cm<sup>2</sup>. This suggests that it is possible to obtain hydrogen whose energy content is larger than the electric energy supplied from outside by operating the cell in those areas.”

As explained above, claims 13 and 14 are not disclosed in or even suggested by Cropley et al. Quang et al. were further cited to show a carbon dioxide absorbing portion. Claims 67 and 77 depend from claims 13 and 14, which are not disclosed by Cropley et al., as explained above. Since Quang et al. (US 4,840,783) do not rectify the deficiency of Cropley et al., claims 67 and 77 depending from claims 13 and 14 are not obvious from Cropley et al. and Quang et al.

On pages 8-10 of the Examiner's answer, it is stated that Applicant has offered no arguments or evidence that this is not the case or that the corresponding components are not equivalent with respect to Cropley et al. and the structurally the same. Appellants reiterate the opposition to the Examiner's answer.

It is to be noted that the structure of the invention resides in the components wherein hydrogen is generated at the fuel electrode. In addition to the structure mentioned above, Appellants further submit that the Office should consider the voltage between the fuel electrode and the oxidizing electrode.

In the Final Office Action dated January 4, 2011, it is stated that the voltage between the electrodes in a generating system is a function of the use of said system and does not relate to the structure of the system and do not have any patentable weight. However, Appellants (i.e., the inventors of the present invention) found that adjusting voltage is essential to contribute to hydrogen generation as mentioned above as well as recited in claims 13 and 14. Appellants submit that claims 13 and 14, including the specific voltage, as a whole, well distinguish from Cropley et al.

Moreover, the Office has not made any specific comments or rationale with respect to “wherein, in a first closed circuit configuration the oxidizing electrode and the fuel electrode are connected to means for withdrawing electric energy from the hydrogen generating cell with the fuel electrode serving as a negative electrode and the oxidizing electrode as a positive electrode” as claimed in claim 13 and “wherein in a second closed circuit configuration the oxidizing electrode and the fuel electrode are connected to means for providing external electric energy with the fuel electrode serving as cathode and the oxidizing electrode as anode” as claimed in claim 14. Cropley et al. do not disclose or suggest these features.

Appellants submit that claims 13 and 14, including the specific voltage, “wherein, in a first closed circuit configuration the oxidizing electrode and the fuel electrode are connected to means for withdrawing electric energy from the hydrogen generating cell with the fuel electrode serving as a negative electrode and the oxidizing electrode as a positive electrode” and “wherein in a second closed circuit configuration the oxidizing electrode and the fuel electrode are connected to means for providing external electric energy with the fuel electrode serving as cathode and the oxidizing electrode as anode” well distinguish from Cropley et al.

Appellants submit that the Examiner’s position has been shown to be untenable by the positions elucidated in the Examiner’s answer.

Claims pending in the application should be allowed over the cited references.

Respectfully Submitted,

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